

PATENT SPECIFICATION

538,948

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COMPLETE SPECIFICATION

A Method of Generating Heat by Chemical Means

We, UNITED STATES APPLIANCE CORPORATION, a corporation organized under the laws of the State of California, United States of America, having its address at 984, Folsom Street, San Francisco, California, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a method of generating heat more particularly for use in the permanent waving of hair. The method according to the invention is particularly suitable for use with a pad of the type disclosed in Specifications Nos. 501,886 and 537,247, wherein an exothermic reaction is carried out between a chemical solution and metallic aluminium.

It is an object of the present invention to provide an improved method of the above character which will afford the desired type of controlled exothermic reaction, and which at the same time will be of such a character as to afford utmost safety. With respect to features affording utmost safety, particular reference can be made to the absence of highly inflammatory or explosive compounds in the solution either before or after reaction, even though the solution may be applied to impregnate cellulose fibre such as blotting paper.

The invention accordingly provides a method of generating heat more particularly for use in the permanent waving of hair, in which an exothermic reaction is produced between metallic aluminium and an aqueous solution of copper nitrate in the absence of substantial amounts of an active oxidising agent.

The exothermic reaction between the aluminium and the copper nitrate solution involves displacement of copper with aluminium, and as a result of the reaction, certain end products or compounds are formed. The solution avoids the use of active oxidizing agents, e.g. sodium chlorate, which are objectionable in solutions of this character.

We have found that copper nitrate can

[Price 1/-]

serve the dual purpose of providing an exothermic reaction with metallic aluminium, and serving as a depolarizer, thus making it unnecessary to use an additional depolarizer or oxidizing agent.

In addition to the copper nitrate content, we may make use of one or more additional salts serving to activate the reaction. We prefer that these salts be such that they afford a chloride ion. For example reference can be made to ammonium chloride, copper ammonium chloride, aluminium chloride, sodium chloride, and potassium chloride.

As specific examples of solutions which can be used with good results, we can make use of a solution formed as follows:—

10 gms. copper ammonium chloride.

29 gms. copper nitrate.

Sufficient water to form a total of 96 cc. of solution.

When the above solution is contacted with metallic aluminium, as for example with a piece of aluminium foil, a controlled exothermic reaction takes place which proceeds efficiently until either the solution or the metallic aluminium are depleted. According to our observations, during the reaction copper is displaced from both the copper ammonium chloride and the copper nitrate, by the metallic aluminium, and the hydrogen ion concentration of the solution changes from an initial relatively high acidity, to a final pH value in the neighbourhood of neutrality or slightly alkaline.

Another solution making use of copper nitrate, which can be employed with good results, is as follows:—

9 gms. ammonium chloride.

40 gms. copper nitrate.

Sufficient water to form a total of 96 cc. of solution.

The last named composition is somewhat similar to the first one specified, except that all of the available copper is in the form of copper nitrate, although the ammonium chloride furnishes a source of chloride ion, the same as copper ammonium chloride. Here again there is a shift in the hydrogen ion concentration of the solution, as an exothermic reaction

proceeds, whereby the pH value changes from an initial acidity to substantial neutrality or slightly alkaline condition, at the end of the reaction.

- 5 The method according to the invention is particularly suitable for use with the types of pad disclosed in Specifications Nos. 501,886 and 537,247. In using these pads, the solution is taken up by the
10 absorbent material of the inner assembly as is fully described in the said Specifications.

- After the pad has been used a part of the original solution remains as an im-
15 pregnating medium in the inner assembly, together with certain end products of the reaction. It has been found that such an impregnated inner assembly remains relatively moist due to the deliquescent or
20 hygroscopic nature of the compounds present. Thus the temperature to which such an inner assembly must be raised before combustion occurs, is relatively high compared to an assembly impregnated with
25 similar chemicals but in dry form. In this connection it can be explained that if the sheets of absorbent material of the inner assembly are formed of ordinary blotting paper, or like cellulose material,
30 the presence of an oxidizing agent like sodium chlorate in substantially dry condition may form a highly inflammable or practically explosive article.

- A further characteristic of the present
35 invention is that the end chemical compounds or products formed during the reaction, are not explosive in character insofar as detonation is concerned. This is likewise true where the absorbent mate-
40 rial of the pad consists of or includes cellulose material.

In addition to the foregoing, the solu-

tions described afford a controlled exothermic reaction in that the interior of the pad is raised to a predetermined temperature 45 and held substantially at such temperature until the end of the reaction period. Also the solution has sufficient reactivity to the aluminium foil to commence a heating period within a reasonable period of 50 time after introduction of the solution into the pad.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be 55 performed, we declare that what we claim is:—

1. A method of generating heat more particularly for use in the permanent waving of hair, in which an exothermic 60 reaction is produced between metallic aluminium and an aqueous solution of copper nitrate in the absence of substantial amounts of an active oxidising agent.

2. A method according to claim 1, in 65 which the copper nitrate solution contains an activator.

3. A method according to claim 2, in which the activator is selected from the group consisting of copper ammonium 70 chloride, ammonium chloride, potassium chloride and sodium chloride.

4. A method of generating heat more particularly for use in the permanent waving of hair substantially as herein- 75 before described.

Dated this 19th day of December, 1939.
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